

Bin-to-Bin Correlation w.r.t. Reaction Plane

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Motivation

Is collective behavior observed at RHIC the ideal hydrodynamic?

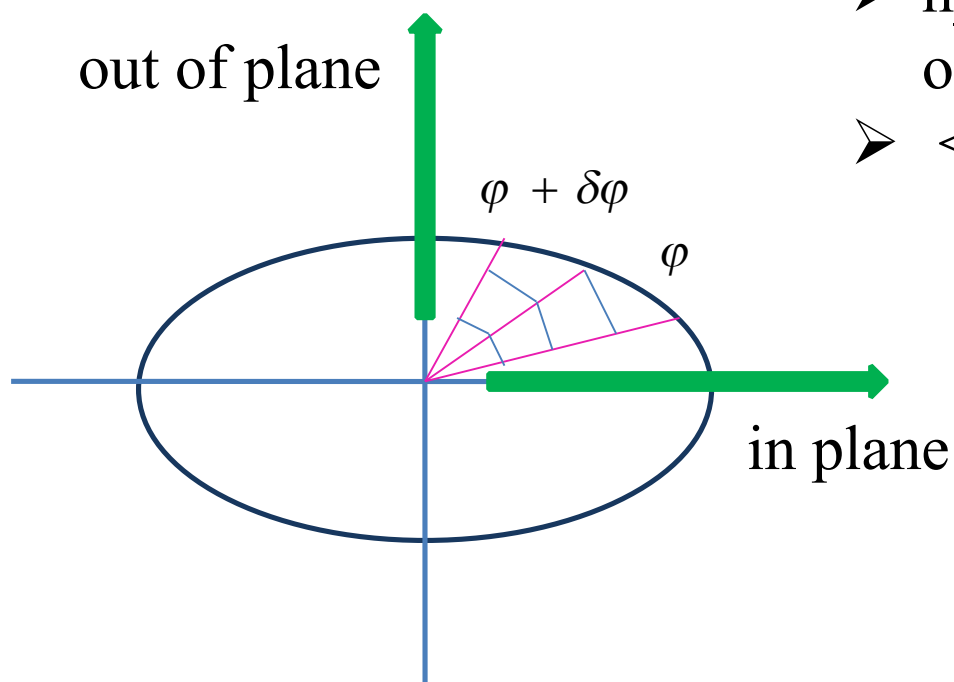


➤ *measure the correlation between the adjacent layers may provide us the information about behavior of the matter*

Definition

Bin-to-Bin Correlation:

$$C_{\varphi, \varphi+\delta\varphi} = \frac{\langle n_{\varphi} n_{\varphi+\delta\varphi} \rangle}{\langle n_{\varphi} \rangle \langle n_{\varphi+\delta\varphi} \rangle} - 1$$



- The azimuthal phase space is divided into N parts;
- The width of each bin is $\delta\varphi = 2\pi/N$;
- n_{φ} is the number of particles lie on the φ ;
- $\langle \dots \rangle$ is the average of event;

Wu Yuanfang, Lianshou Liu, Yingdan Wang, Yuting Bai and Hongbo Liao, PRE71, 017103 (2005).

Data Set

Au+Au Collisions at 200 GeV (run 4)

Event Set

Trigger ID	Vertex cut (cm)	Event used	Tracks per event
15007	$ V_z < 30$	1,000,000	≥ 10

Track Set

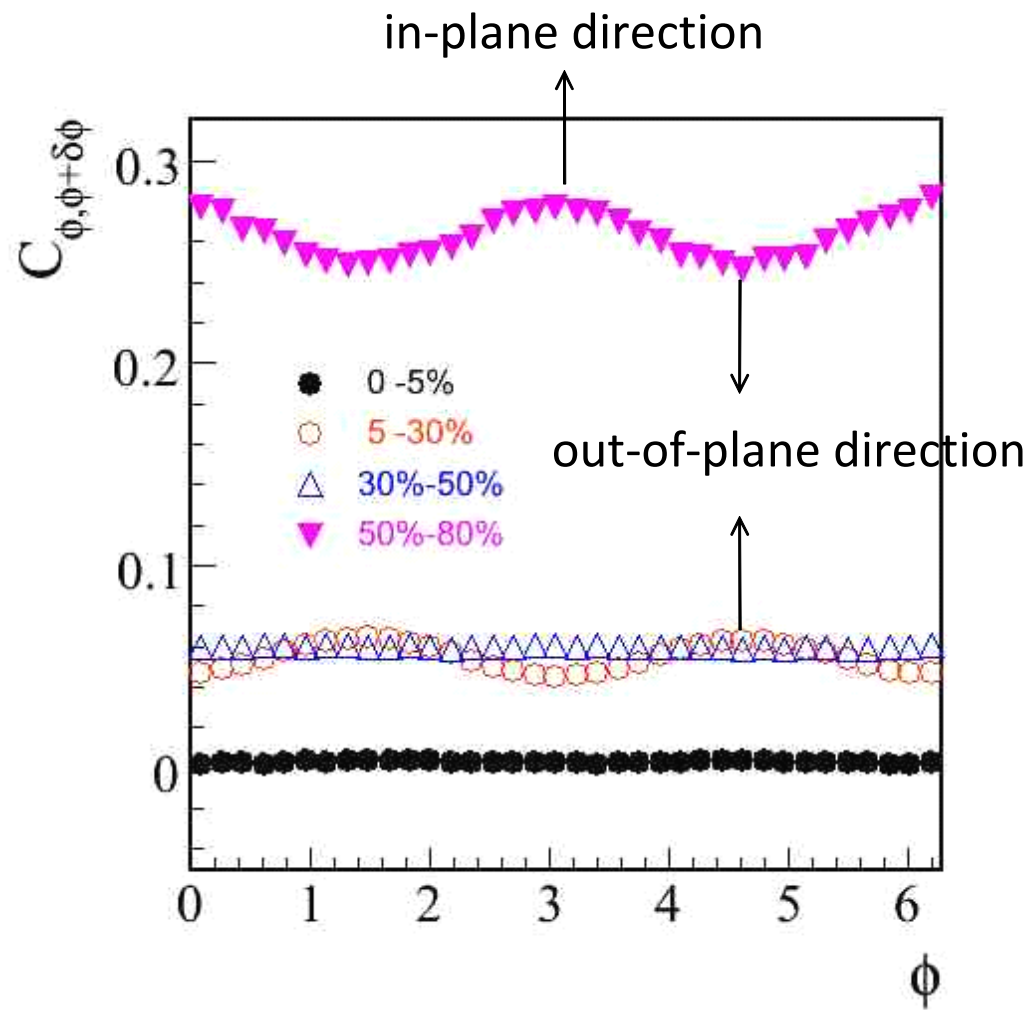
nHitFits	Dca cut (cm)	p_T cut (GeV/c)	η Cut
≥ 10	< 2.0	$0.1 < p_T < 2.0$	$ \eta < 1.0$

In order to avoid self correlation, two methods are used to reconstruct reaction plane:

Method a: particles in most central region $|\eta| < 0.5$ are used to computer the correlation, and particles left are used to reconstruct the reaction plane;

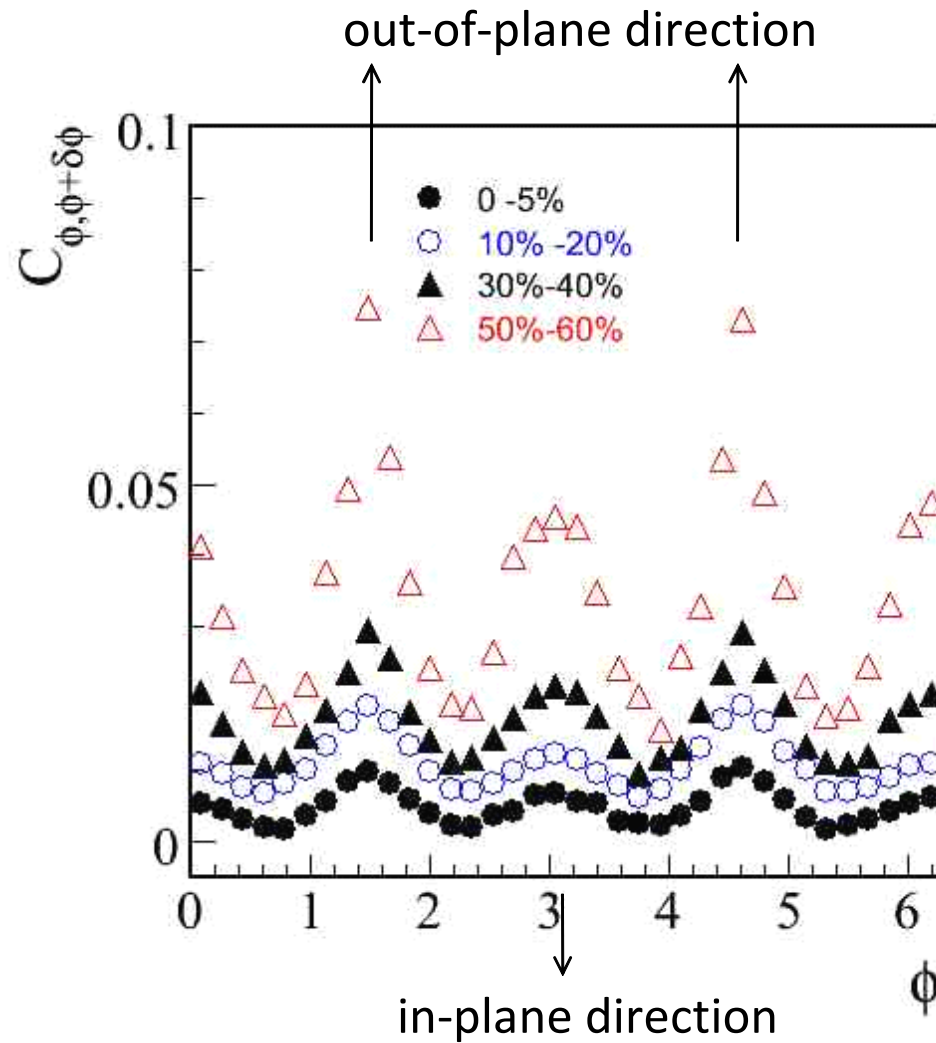
Method b: each particle's phi w.r.t reaction plane is obtained while all the soft particles left are used to reconstruct the reaction plane.

Results of *method a*



The out-of-plane enhancement is observed for near central collisions while the in-plane enhancement is observed for peripheral collisions.

Results of *method b*



Both the in-plane and out-of-plane enhancements are observed in different centrality collisions.

Simulation

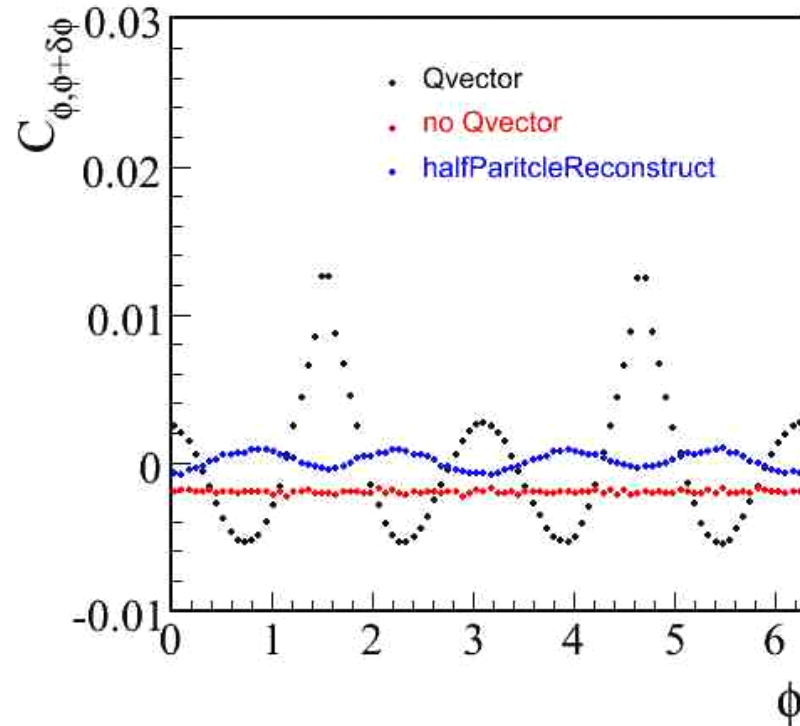
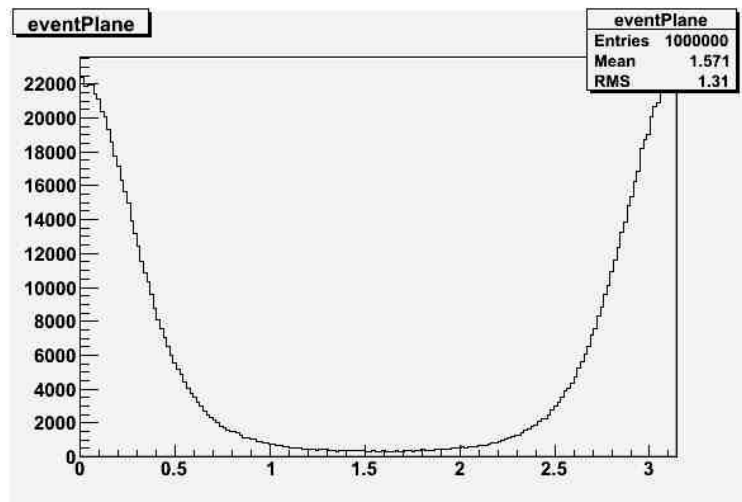
- Particles are randomly generated while reaction plane angle is considered as 0.
- Only effect of v_2 is considered.

red points: original generated ϕ is used.

blue points: *method a*

black points: *method b*

main difference: particles are rotated same/different angle(s) w.r.t. reaction plane in one event.



The results of method b of data are driven by the way we reconstruct the reaction plane.

Summary

- Bin-to-Bin correlation is very sensitive to the precision of the reconstructed reaction plane.
- Even there is a signal, it should be weak, and all the none-related effect need to be subtracted.